



ICAO ENGINE nvPM EMISSIONS DATA SHEET

SUBSONIC ENGINES

| | | | |
|------------------------|--------------|--------------------------------|-------|
| ENGINE IDENTIFICATION: | Trent7000-70 | BYPASS RATIO (-): | 9.1 |
| UNIQUE ID NUMBER: | 02F23RR140 | PRESSURE RATIO π_{co} (-): | 44.1 |
| COMBUSTOR: | Phase5 Tiled | | |
| ENGINE TYPE: | TF | RATED OUTPUT F_{oo} (kN): | 317.8 |

REGULATORY DATA

| CHARACTERISTIC VALUES: | LTO_{mass}/F_{oo} (mg/kN) | LTO_{num}/F_{oo} (particles/kN) | NVPM MASS CONCENTRATION ($\mu\text{g}/\text{m}^3$) |
|------------------------------------|--------------------------------|--------------------------------------|---|
| LTO/F_{oo} AND MAX $nvPM_{mass}$ | 208.4 | 1.75E+15 | 3410 |
| AS % OF CAEP/10 LIMIT | - | - | 86.0 |
| AS % OF CAEP/11 LIMIT (InP) | 60.0 | 42.1 | |
| AS % OF CAEP/11 LIMIT (NT) | 97.4 | 63.1 | |

MEASURED DATA

| MODE | POWER SETTING (% F_{oo}) | TIME minutes | FUEL FLOW kg/s | EMISSIONS INDICES* | | NVPM MASS CONCENTRATION PEAK $nvPM_{mass}$ ($\mu\text{g}/\text{m}^3$) |
|---|--------------------------------|-----------------|-------------------|------------------------|------------------------------|---|
| | | | | EI_{mass} (mg/kg) | EI_{num} (particles/kg) | |
| TAKE-OFF | 100 | 0.7 | 2.373 | 54.7 | 1.72E+14 | |
| CLIMB OUT | 85 | 2.2 | 1.943 | 94.1 | 3.24E+14 | |
| APPROACH | 30 | 4.0 | 0.645 | 70.2 | 8.41E+14 | |
| IDLE | 7 | 26.0 | 0.250 | 18.5 | 4.38E+14 | |
| LTO TOTAL (kg, mg, number of particles) | | | 900 | 47639 | 4.01E+17 | - |
| NUMBER OF ENGINES | | | | 1 | 1 | 1 |
| NUMBER OF TESTS | | | | 3 | 3 | 3 |
| AVERAGE LTO/F_{oo} VALUES (mg/kN, particles/kN) | | | | 149.9 | 1.26E+15 | - |
| MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ($\mu\text{g}/\text{m}^3$) | | | | 151.8 | 9.59E+14 | 2649 |

* Emissions Indices are corrected for thermophoretic loss and fuel hydrogen content

DATA FOR EMISSIONS INVENTORIES (ESTIMATIONS FOR ENGINE EXIT PLANE VALUES)

| MODE | POWER SETTING (% F_{oo}) | CORRECTED EMISSIONS INDICES | |
|-----------|--------------------------------|-----------------------------|-----------------------------------|
| | | $EI_{mass_{sl}}$ (mg/kg) | $EI_{num_{sl}}$ (particles/kg) |
| TAKE-OFF | 100 | 58.7 | 2.35E+14 |
| CLIMB OUT | 85 | 102.0 | 4.84E+14 |
| APPROACH | 30 | 81.3 | 1.89E+15 |
| IDLE | 7 | 22.4 | 8.80E+14 |

AMBIENT CONDITIONS

| AMBIENT CONDITIONS | | | FUEL | |
|--------------------------------|--------|--------|-------------------------------|-------|
| | From | To | | |
| BAROMETER (kPa) | 100.8 | 101.6 | HEAT OF COMBUSTION (MJ/kg) | 43.34 |
| TEMPERATURE (K) | 287.0 | 292.6 | HYDROGEN CONTENT (%mass) | 13.97 |
| HUMIDITY (kg water/kg dry air) | 0.0080 | 0.0090 | AROMATICS CONTENT (%vol) | 15.9 |
| | | | NAPHTHALENE CONTENT (%vol) | 0.11 |
| | | | SULPHUR CONTENT (ppm by mass) | 300 |

| | |
|--------------------|-----------------|
| MANUFACTURER: | Rolls-Royce plc |
| TEST ORGANIZATION: | Rolls-Royce plc |
| TEST LOCATION: | Derby |
| TEST DATES: | 04/10/2018 |

REMARKS

1. Certification Report EDNS01000740804
2. Correction of minor error in reported nvPM data
3. The maximum EI_{mass} occurs between 30% and 85% F_{oo}
4. The maximum EI_{num} occurs between 30% and 85% F_{oo}